

Instituut voor Dierkunde, Rijksuniversiteit Gent, Belgium
and
Embrapa (Cpac. Planaltina), DF. Brazil.

LONGIDORIDAE (NEMATODA: DORYLAIMIDA) FROM BAHIA STATE, BRAZIL

by
F. RASHID, A. COOMANS and R. D. SHARMA

In soil samples collected in Bahia State, Brazil, a new *Xiphinema*, a new *Xiphidorus* and a new *Longidoroides* species were identified, but only the *Xiphidorus* species is named, due to lack of specimens for the other two new species. *Xiphidorus minor* n.sp. is the eighth species of *Xiphidorus*. All previously described species were reported from South America. The representative of the genus *Longidoroides* is the first record of this genus from South America. Three known *Xiphinema* species were also present, *X. krugi* Lordello, 1955, *X. ifacolum* Luc, 1961 and *X. vulgare* Tarjan, 1964 and these are described and discussed. First stage juveniles of *X. ifacolum* and *X. vulgare* are reported for the first time. *X. krugi* and *X. vulgare* are widely distributed in Brazil.

Material and Methods

The soil samples were collected by one of us (R.D.S.). The nematodes were extracted by the centrifugation-flotation technique, fixed with hot 5% formaldehyde, processed to pure glycerin by a modified Seinhorst's method and mounted between coverslips on aluminium slides. For some flattened specimens the dimensions of the body diameters have been corrected by using Geraert's (1961) formula.

Description of the species

XIPHINEMA IFACOLUM Luc, 1961 (Fig. 1)

The females and juveniles in the Bahia State have similar morphometrics and morphology to the original description of the species (Luc, 1961) and the further description of the specimens from Bahia State by Loof and Sharma (1979). This species is easily recognised by the conoid tail with fine terminal core, also present in the juvenile stages. First stage juveniles are reported for the first time. They agree in most respects with second stage juveniles except for the position of the replacement odontostyle and the longer and more slender tail. The main dimensions are as follows (n=5): L=0.87 (0.8-0.9) mm; a=38 (34-40); b=3.3 (3.3-3.4); c=11.5 (11-12); c'=5 (4.5-5.5); body width=23 (22-25) μm ; odontostyle=57 (55-60) μm ; odontophore=40 (37-42) μm ; total spear=97 (93-102) μm ; guide ring from anterior end=47.5 (46-49) μm ; replacement odontostyle=71 (68-76) μm ; tail length=76 (72-80) μm .

Habitat and localities: around the roots of *Theobroma cacao* L. cv. Comun at Ibarataia, Faz. Boa Esperança (1 ♀) and Gandu, Faz. Asonara Dois, Bahia State, Brazil (1 ♀, 5 J1, 1 J2, 1 J4).

XIPHINEMA KRUGI Lordello, 1955 (Fig. 2)

The specimens studied agree well with those described by Cohn and Sher (1972), Frederick and Tarjan (1974), Williams and Luc (1977), Heyns (1977), Luc and Hunt (1978), Loof and Sharma (1979) and Ferraz (1980).

Luc and Hunt (1978) redefined *X. krugi* and they described considerable variations in body length, spear length, anterior genital branch length and tail length and shape. In our populations the variability of tail length and tail shape and of anterior genital branch length corresponds to that reported by Luc and Hunt (1978). Out of thirteen females, eight had tails with a distinct ventral peg.

Xiphinema krugi is widely distributed in Brazil. Ferraz (1980) described populations (300 females) from ten states. According to him, Brazilian populations agree well with those of Luc and Hunt (1978), particularly in variation of tail shape. He found 90% of the females with a more or less pronounced ventral knob on the tail.

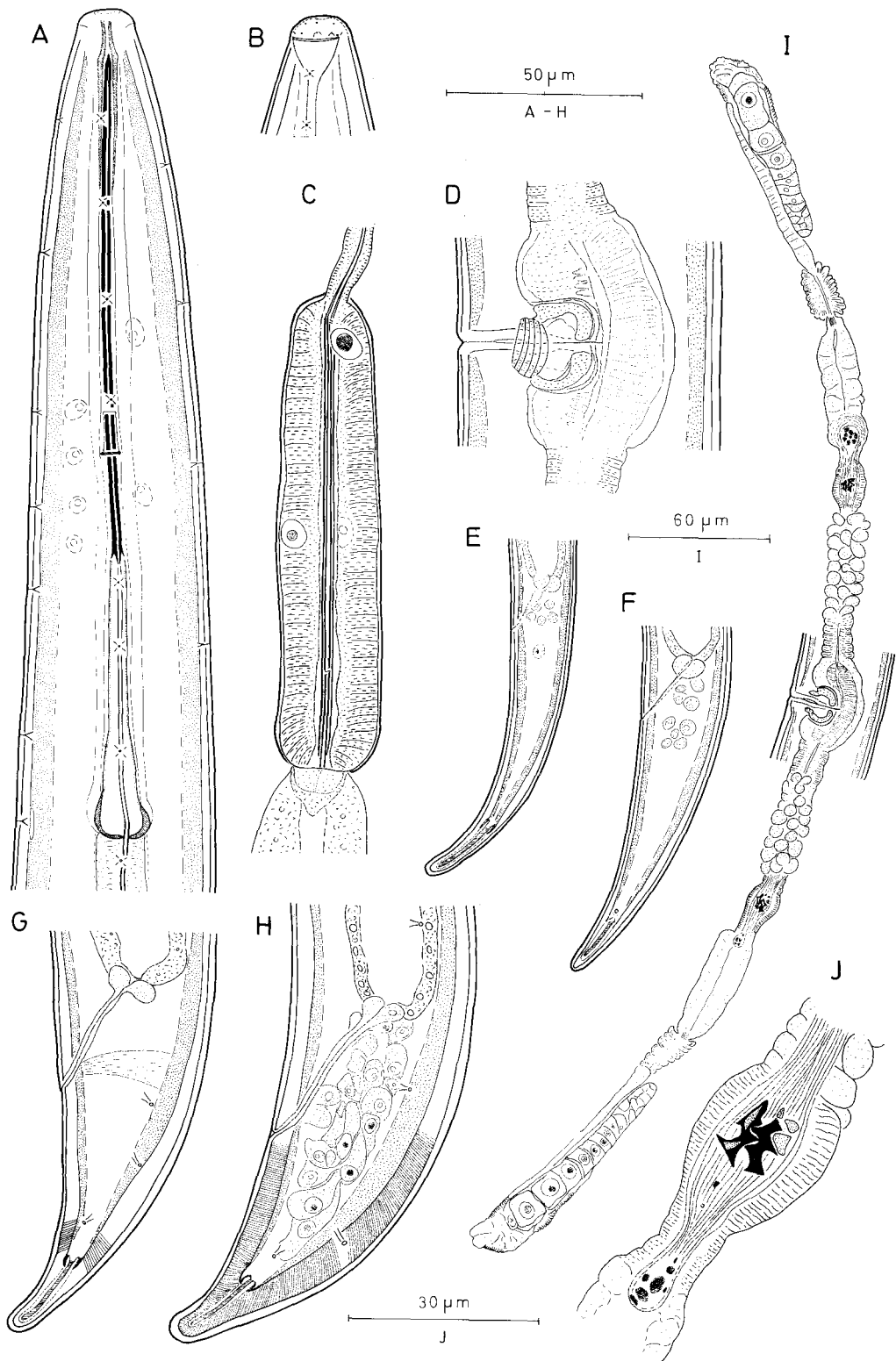


Fig. 1 - *Xiphinema ifacolum*. A: Spear region female; B: Head end (surface view); C: Pharyngeal bulb; D: Vagina and vulva region; E: Tail J1; F: Tail J2; G: Tail J4; H: Female tail; I: Female reproductive system; J: Z-organ.

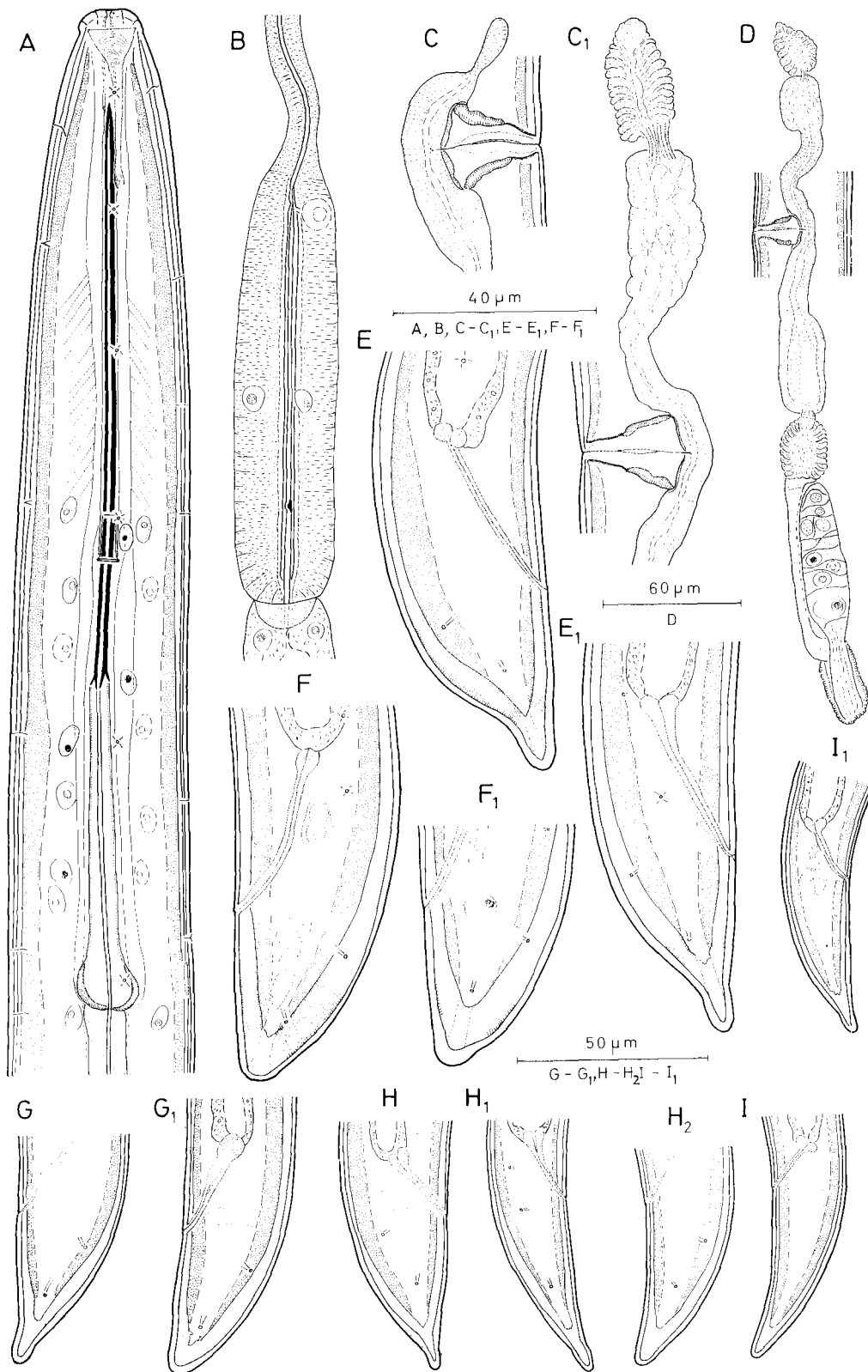


Fig. 2 - *Xiphinema krugi*. A: Spear region female; B: Pharyngeal bulb; C-C₁: Female reproductive system, anterior branch; D: Female reproductive system; E-E₁ and F-F₁: Female tails; G-G₁: Tails J4; H-H₂: Tails J3; I-I₁: Tails J2.

Habitat and localities. Soil around the roots of *Theobroma cacao* L. from Ilhéus, Cepec, Quadra «G», Faz. Campina; Mutuipe and Itamaraju, Faz. Modelo, Bahia State, Brazil.

XIPHINEMA sp. (Fig. 3)

Measurements: female (n=1): L=1.9 mm; body width=47 μm ; a=41; neck length=196 μm ; b=4.9; tail length=33 μm ; c=59; c'=1.2; V=38; odontostyle=111 μm ; odontophore=66 μm ; total spear=177 μm ; guide ring=102 μm .

Body 'C' shaped, after fixation. Cuticle appearing smooth on outside, internally with fine transverse striations. Lateral chord about 25% of corresponding body width. Lateral body pores distinct throughout the body length. Five dorsal and seven ventral pores observed in neck region. Head rounded, 5.5 μm high and 10.5 μm wide, slightly demarcated from body contour. Amphid stirrup-shaped. Amphidial aperture slightly more than half of the corresponding head width (Fig. 3B). A very small mucro, about 2 μm long, present in the wall of the slender pharynx. Pharyngeal bulb 76 μm long and 20 μm wide. Dorsal gland nucleus large, opposite the gland outlet. SN smaller than DN. Nerve ring 206 μm from head end. Hemizonid 7 μm wide, located 144 μm from anterior end, opposite base of odontophore. Cardia distinct, rounded, 8 μm long. Prerectum 392 μm long. Rectum 38 μm long i.e. about 1.4 times the anal body diameter. Female pseudomonodelphic. Anterior branch reduced, composed of an oviduct pouch, a sphincter and an uterus, about 176 μm long. Posterior branch fully developed, 292 μm long, composed of an ovary, an oviduct, a sphincter and an uterus. Uterus differentiated into a distinctly muscular distal part and a wide proximal part (Fig. 3H). Vulva a transverse slit. Vagina 21 μm long. No spermatozoa, no sclerotized bodies or spines present. Tail dorsally convex-conoid with distinct ventral peg. Cuticle with minute oblique radial striae around the tail. Two caudal pores present at each side. A blind terminal canal present.

Male: not found.

Juveniles: first and third stage juveniles found. Similar to adult except for the longer and differently shaped tail (Fig. 3F and G).

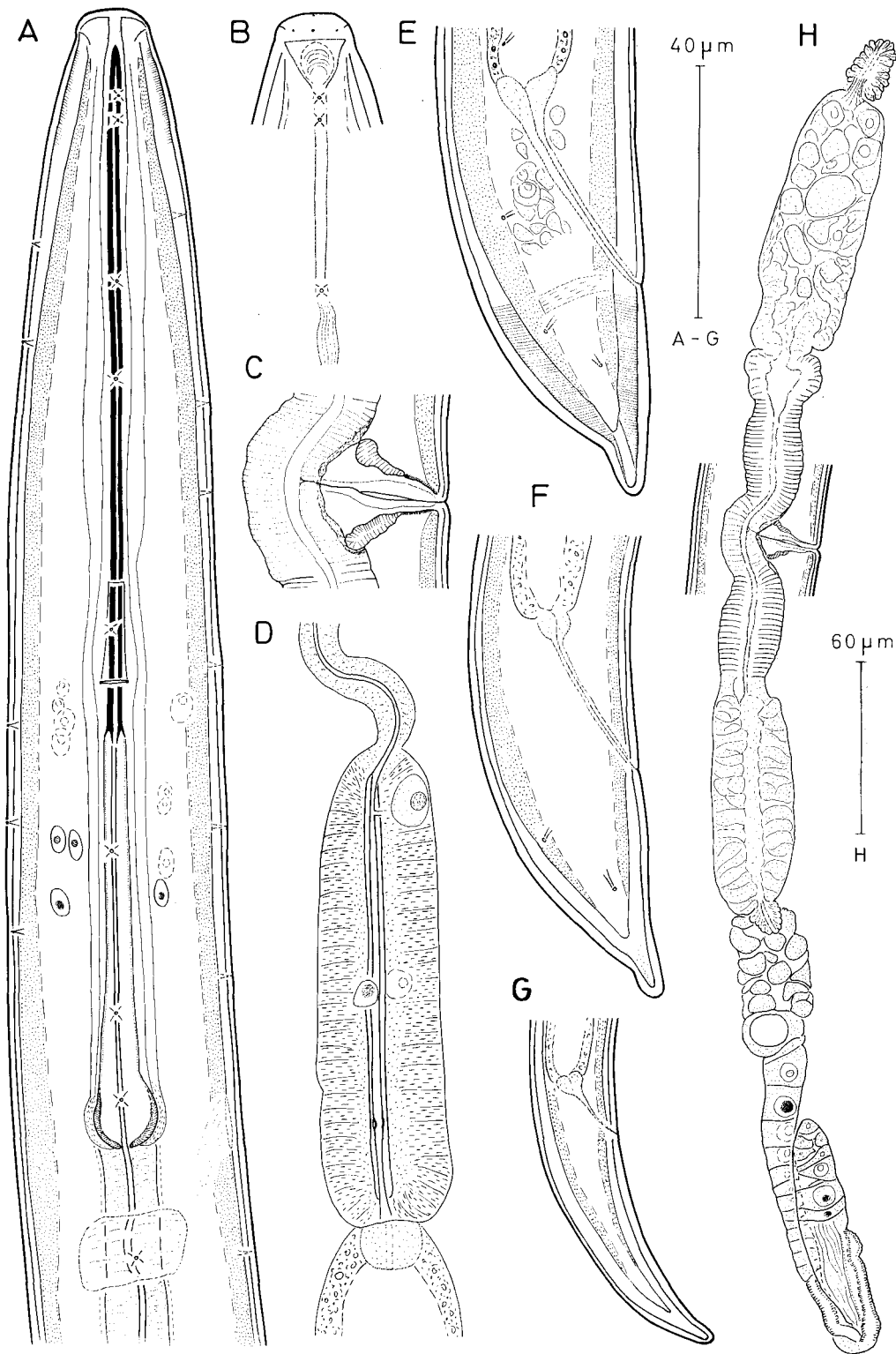


Fig. 3 - *Xiphinema* sp. A: Spear region female; B: Head end (surface view); C: Vagina and vulva; D: Pharyngeal bulb; E: Female tail; F: Tail J3; G: Tail J1; H: Female reproductive system.

Type habitat and locality. Light-sandy soil around the roots of *Theobroma cacao* L. from Itamaraju, Faz. Vigia, Bahia State, Brazil.

Relationships

Xiphinema sp. is closely related to *X. krugi* Lordello, 1955 and *X. dimidiatum* Loof et Sharma, 1978. It can be differentiated from *X. krugi* by the longer anterior branch and the muscular structure of the uterus. *X. dimidiatum* has an equally long anterior branch but it differs in the structure of the uterus and in the presence of sclerotized spines, not mentioned in the original description but observed in the paratypes. The reproductive system of the new species closely resembles that of *X. surinamense* Loof et Maas, 1972. The latter species also shows a very great variability in such characters that are otherwise rather constant or at least less variable (e.g. spear length, body length, spicule length), hence the dimensions of the specimen under study fall completely within the range given for *X. surinamense* (Loof and Maas, 1972; Loof and Sharma, 1979). The present specimen however, differs from *X. surinamense* in tail shape (short hemispherical without blind canal in *X. surinamense*).

XIPHINEMA VULGARE Tarjan, 1964 (Fig. 4)

The specimens studied are considered as *X. vulgare* Tarjan, 1964, because the females agree with the original description given by Tarjan (1964) and also with the descriptions of populations of *X. vulgare* given by Loof and Maas (1972), Williams and Luc (1977), Loof and Sharma (1979), Ferraz (1980) and Brown *et al.* (1981).

The main dimensions of the females are (n=32): L=2.5 (2.2-2.8) mm; a=55.9 (47-62); b=5.4 (4.6-6.2); c=49 (40-64); c'=1.7 (1.5-2.1); V=39.8 (36-42); odontostyle=117 (110-126) μm ; odontophore=71.6 (67-76) μm ; spear=189 (181-202) μm ; guide ring=109 (99-115) μm ; tail length=53 (40-60) μm ; length of hyaline part tail=17.5 (14-21) μm .

The spear length of our females resembles that of *X. setariae* Luc, 1958, but the body length, the tail structure and the length of the hyaline terminal portion are different. According to Luc and Dalmaso (1975), the length of the hyaline terminal part is the most reliable character to separate *X. vulgare* from *X. setariae*. Although this has been confirmed by other authors the reliability of this character remains questionable. *X. vulgare* has been studied from Brazil by Loof and Sharma (1979) from

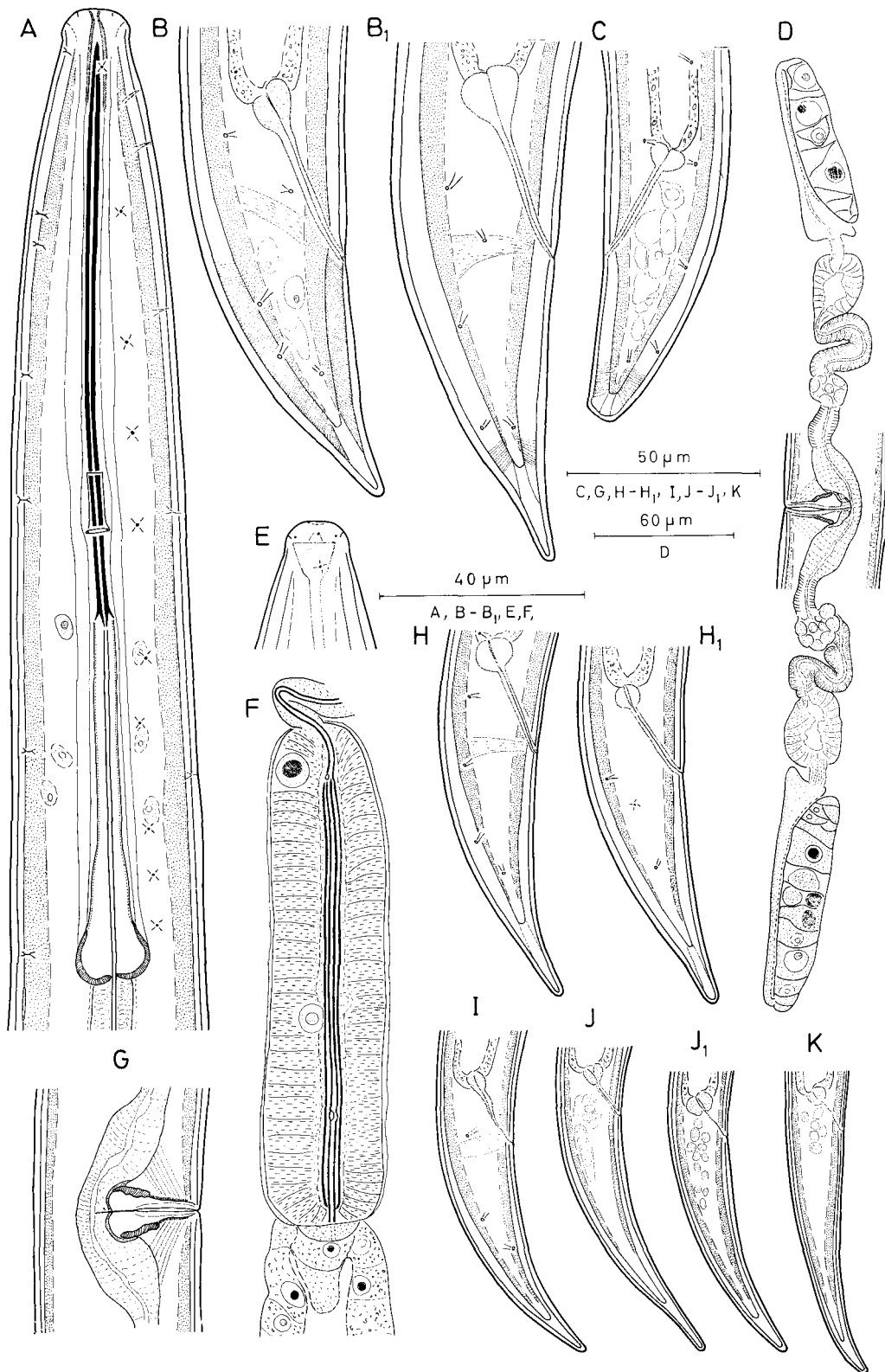


Fig. 4 - *Xiphinema vulgare*. A: Spear region female; B-B₁: Female tails; C: Aberrant female tail; D: Female reproductive system; E: Head end (surface view); F: Pharyngeal bulb; G: Vagina and vulva region; H-H₁: Tails J₄; I: Tail J₃; J-J₁: Tails J₂; K: Tail J₁.

Bahia State, where it is very common and widely distributed, and by Ferraz (1980) from ten states of Brazil. Our specimens differ from previously described Brazilian populations in having a relatively shorter body and longer spear.

All juvenile stages have been found; the stages can be distinguished by the increase in body length and in the length of the replacement odontostyle. These juveniles agree with the Indonesian populations described by Brown *et al.* (1981). However, some differences occur in tail length. The first stage juvenile has been found for the first time. Main dimensions are as follows:

First juvenile stage (n=20): L=0.74 (0.6-0.8) mm; a=36 (30-40); b=3.2 (2.8-3.6); c=13.5 (12-18); c'=4.2 (3.2-5.1); odontostyle=48 (38-51) μm ; odontophore=35 (30-38) μm ; total spear=83 (68-87) μm ; guide ring=41 (31-44) μm ; replacement odontostyle=60 (44-68) μm ; tail length=55.4 (39-68) μm .

Second juvenile stage (n=14): L=0.98 (0.8-1.2) mm; a=39.9 (35-48); b=3.4 (3-4); c=16.6 (14-20); c'=3.7 (2.5-5.2); odontostyle=62 (59-67) μm ; odontophore=44 (40-48) μm ; total spear=106.5 (100-111) μm ; guide ring=56 (50-61) μm ; replacement odontostyle=82 (75-88) μm ; tail length=59.5 (42-66) μm .

Third juvenile stage (n=4): L=1.37 (1.3-1.4) mm; a=46.4 (45-48); b=3.8 (3.8-3.9); c=21.3 (20-23); c'=3.1 (2.9-3.3); odontostyle=84 (80-87) μm ; odontophore=51 (47-55) μm ; total spear=135 (127-139) μm ; guide ring=76.7 (74-80) μm ; replacement odontostyle=96 (88-100) μm ; tail length=64.4 (60-67) μm .

Fourth juvenile stage (n=10): L=1.76 (1.4-2.0) mm; a=52.2 (43-58); b=4.2 (3.7-5.9); c=28.1 (23-31); c'=2.4 (2.1-2.7); odontostyle=94.6 (81-101) μm ; odontophore=61.7 (57-64) μm ; total spear=156 (138-164) μm ; guide ring=87.8 (71-96) μm ; replacement odontostyle=116 (104-125) μm ; tail length=62 (53-69) μm .

Habitat and localities. Heavy and sandy soil around the roots of *Theobroma cacao* L. from Itamaraju, Faz. Modelo; Itamaraju, Faz. Pedra Grande and Ilhéus, Cepec, Quadra «G».

XIPHIDORUS MINOR sp. n. (Table I and Fig. 5)

Females: body short, tapering towards both ends, assuming 'C' to spiral shape when fixed. Cuticle, 1.5 μm thick with outer layer smooth and inner

Table I - *Morphometrics of Xiphidurus minor sp. n. from Bahia Sate.*

| LOCALITY | Itamaraju, Faz. Modelo (type population) | | | | | Ilhéus, Cepec, Quadra 'H' | | |
|---------------------------------------|--|-----------------------|-----------|----------------|----------------|---------------------------|-----------|-----------|
| | Holotype (♀) | Paratypes (n=2 ♀♀) | J 2 (n=2) | J 3 (n=3) | J 4 (n=4) | (n=4 ♀♀) | J 2 (n=1) | J 3 (n=2) |
| L mm | 1.75 | 1.72-1.74 | 0.71-0.76 | 1.06 (1.0-1.1) | 1.24 (1.2-1.4) | 1.74 (1.6-1.9) | 0.7 | 1.0 |
| a | 62 | 57-62 | 39-51 | 48.0 (46-51) | 57.7 (50-62) | 66.7 (63-72) | 48 | 53 |
| b | 6.5 | 6.4-6.6 | 3.8-5.2 | 5.9 (5.3-6.4) | 6.3 (5.4-7.9) | 7.2-7.4* | — | — |
| c | 68 | 75-83 | 24-27 | 40.0 (38-43) | 47.7 (42-57) | 72.0 (66-81) | 27 | 37-41 |
| c' | 1.3 | 1.3 | 2.6-2.7 | 1.7 (1.7-1.9) | 1.7 (1.6-1.8) | 1.4 (1.4-1.6) | 2.6 | 1.8-2.0 |
| V | 47 | 46-48 | — | — | — | 49.5 (49-51) | — | — |
| Odontostyle μm | 77 | 73-79 | 44-45 | 53.5 (51-55) | 64.5 (62-66) | 75.0 (74-76) | 43 | 53-55 |
| Odontophore μm | 37 | 36-37 | 25-26 | 29.5 (27-30) | 32.5 (31-34) | 35.0 (34-36) | 26 | 29-30 |
| Total spear μm | 114 | 109-116 | 69-71 | 83.0 (82-85) | 97.0 (93-100) | 110.0 (108-111) | 70 | 82-85 |
| Guide ring μm | 68 | 67-68 | 37-39 | 47.0 (46-48) | 60.5 (54-70) | 65.0 (64-66) | 36 | 47-48 |
| Replacement odontostyle μm | — | — | 50-53 | 65.0 (62-67) | 72.5 (67-77) | — | 54 | 63-64 |
| Pharynx μm | 152 | 143-148 | — | — | — | 137-146 | — | — |
| Tail length μm | 26 | 21-23 | 28-29 | 27.0 (23-29) | 26.5 (24-28) | 24.5 (22-28) | 26 | 24-28 |
| Anal body width μm | 19 | 16-17 | — | — | — | 16.0 (14-18) | — | — |
| Body width μm | 28 | 28-30 | 15-18 | 22.5 (20-23) | 21.5 (20-23) | 26.0 (25-27) | 15 | 18-20 |

* n=2

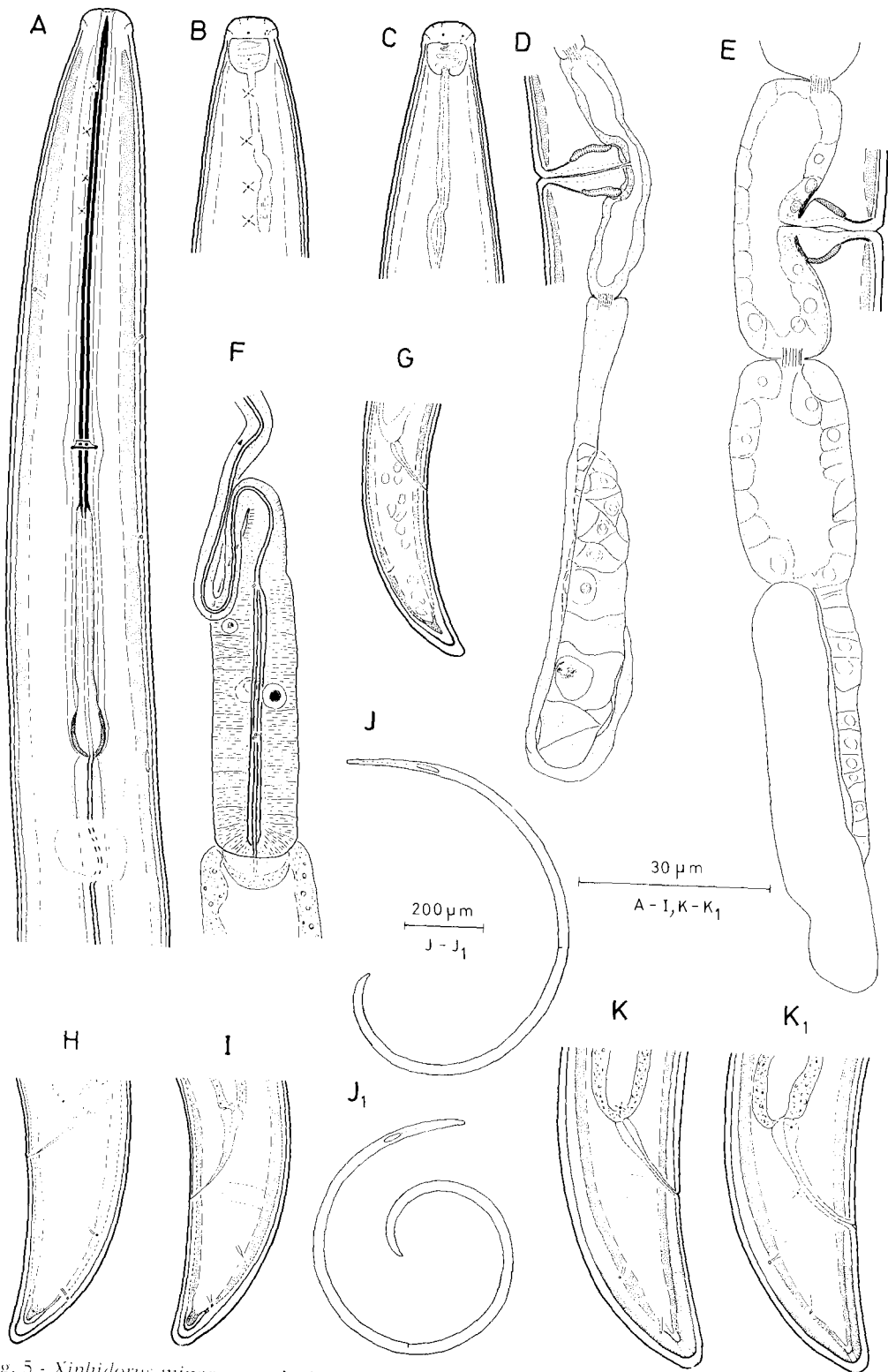


Fig. 5 - *Xiphidorus minor* sp. n. A: Spear region female; B-C: Head region (surface view); D-E: Female reproductive system (posterior branch); F: Pharyngeal bulb; G: Tail J2; H: Tail J4; I: Tail J3; J-J₁: Female body-shapes; K-K₁: Female tails.

layer finely striated. Cuticle increasing to 3 μm on dorsal side of tail. Lateral chord occupying 1/3 to 1/4 of body width. Lateral body pores rather indistinct, only four observed in odontostyle region. Two ventral and one dorsal pore in spear region. Lip region rounded, with slight constriction at adjoining neck, 6 μm high and 8-9 μm wide. Amphid large, not distinctly bilobed. Amphidial aperture a small slit (Fig. 5B and C). Odontophore with moderately developed flanges. A very small mucro present posterior to odontophore base. Nerve ring 134 (131-138) μm from head end. Hemizonid posterior to nerve ring, about 142 μm from anterior extremity, 2.5 μm wide. Pharyngeal bulb 61.5 (58-66) μm long and 13 (12.5-14) μm wide. Dorsal gland nucleus small, about 6 μm behind corresponding outlet. Ventrosublateral gland nuclei larger than DN. Pharyngo-intestinal junction hemispheroid, with two parts, 6.5 (5-10) μm long. Prerectum 235-242 μm long. Rectum 19-21 μm long i.e. about 1.1 times the anal body diameter. Female didelphic-amphidelphic. Both genital branches composed of an ovary, an oviduct, a sphincter and an uterus. Uterus very short, separated from pars dilatata oviductus by a muscular sphincter. Pars dilatata oviductus with distinct cells (Fig. 5D and E). Vulva a transverse slit. Vagina 14-16 μm long. No spermatozoa or sclerotized spines present. Tail dorsally convex-conoid, with rounded terminus. Inner cuticle with faint oblique radial striae around the tail. Two caudal pores at each side. A blind terminal canal present.

Male: not found.

Juveniles: second, third and fourth stage juveniles found. Identical to females, except for tail length; especially during second and third stages, the tail is longer than in adults (Fig. 5G and H).

Type habitat and locality: light soil around the roots of *Theobroma cacao* L. cv. Comun at Itamaraju, Faz. Modelo, Bahia State, Brazil.

Other habitat and locality: medium loamy soil around the roots of *T. cacao* L. cv. Comun at Ilhéus, Cepec, Quadra «H», Bahia State, Brazil.

Differential diagnosis

Xiphidorus minor sp. n. can be distinguished from all previously described species by the very short uterus. It resembles *X. saladillensis* Chaves *et* Coomans, 1984, in having a similar small body, but it can be differentiated by head-, amphid- and tail-shape and by relatively longer spear and pharyngeal bulb.

LONGIDOROIDES sp. (Fig. 6)

Measurements: female (n = 1), L = 5.3 mm; body width = 88 μm ; a = 60; neck length = 318 μm ; b = 8.2; tail = 19 μm ; c = 28; c' = 0.7; odontostyle = 175 μm ; odontophore = 108 μm ; total spear = 283 μm ; guide ring = 60 μm ; V = 41.

Body straight when relaxed. Cuticle appearing smooth, 7.5 μm thick at base of neck region, 10 μm thick at mid-body and 18 μm thick in tail region, composed of three layers, middle layer thick and dark. Lateral body pores distinct throughout the body. No dorsal pores observed. Two ventral pores within spear region, one ventral pore opposite odontostyle base leading to a transverse tube in the cuticle (Fig. 6A). Head rounded, 9 μm high and 12.5 μm wide; not offset but narrower than adjoining body. Amphidial fovea large, goblet-shaped, with a large slit-like aperture, presenting two anterior extensions (Fig. 6B). Odontostyle slightly bent, with plain base. Odontophore slightly wider at basal part. A large 13.5 μm long mucro present (Fig. 6F). Nerve ring rather indistinct, 267 μm from head end, surrounding the odontophore. Hemizonid anterior to nerve ring about 250 μm from anterior end. Anterior part of pharynx a narrow cylinder; pharyngeal bulb 113 μm long and 33 μm wide. Pharyngeal gland nuclei indistinct, outlets of ventrosublateral glands close to base of pharyngeal bulb (Fig. 6C). Cardia large, conoid, 11 μm long. Intestine with small refracting granules. Prerectum 560 μm long. Rectum 37 μm long. Female amphidelphic-didelphic, both genital branches well developed, with an ovary, an oviduct and an uterus; anterior branch 412 μm long and posterior one 499 μm long. Uterus large and broad, filled with rounded spermatozoa (Fig. 6E). Vulva a transverse slit in ventral view, 17.5 μm long. Tail convex-conoid, rounded. Two caudal pores present at each side. Cuticle thickened at the terminus and distinctly striated with faint oblique radial striae around tail.

Male: not found.

Type habitat and locality: heavy soil around the roots of *Theobroma cacao* L. (Clone) at Ilhéus, Cepec, Quadra «G» Bloco I, Bahia State, Brazil.

Relationships

Longidoroides sp. can be distinguished from all previously described species by the long stylet and straight habitus. This species is related to *L. cedari* Khan *et al.*, 1978 and *L. strelitziae* Heyns, 1966, in having a similar

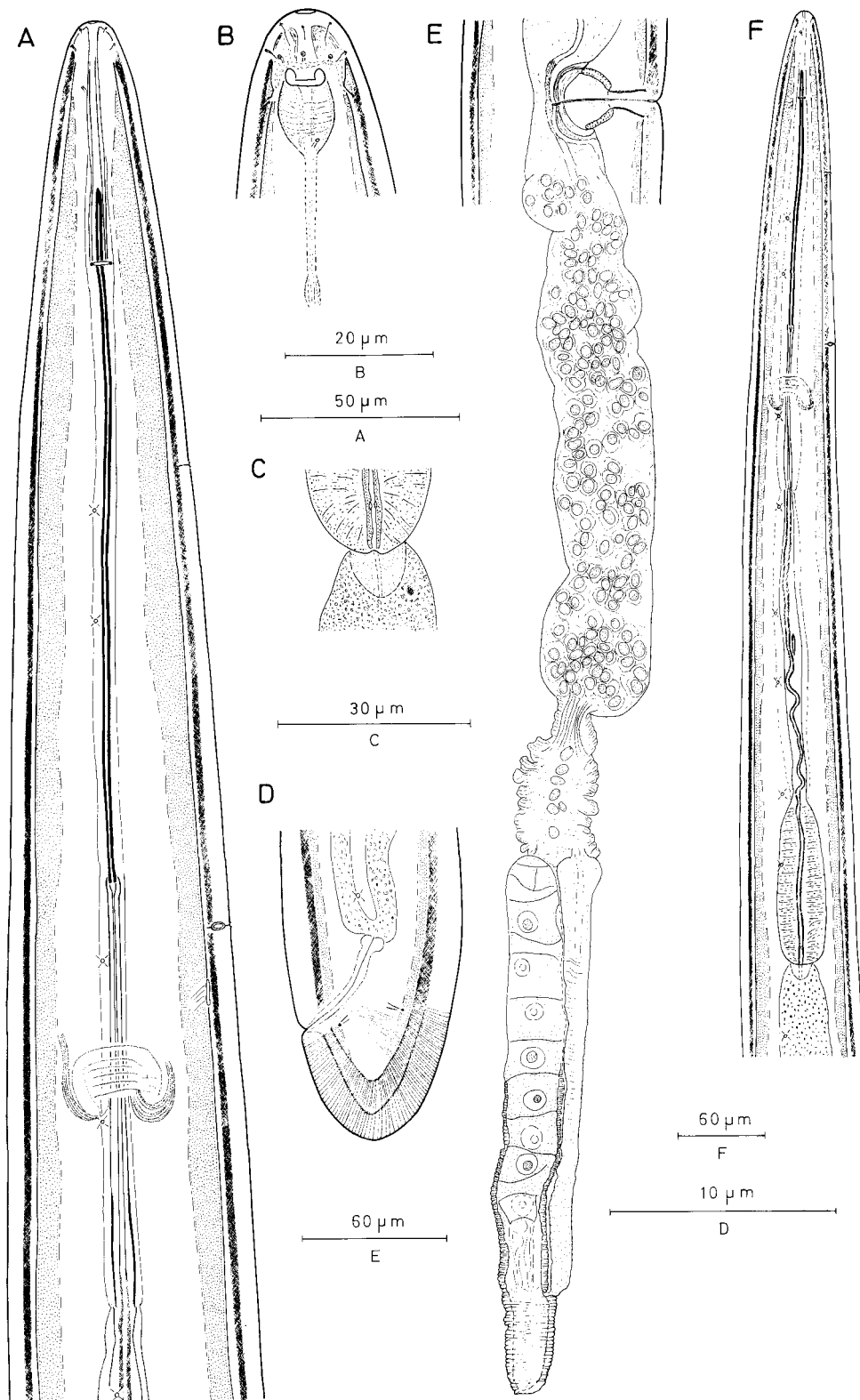


Fig. 6 - *Longidoroides* sp. Female. A: Spear region. B: Head region (surface view); C: Cardia region; D: Tail region; E: Female reproductive system (posterior branch); F: Anterior region.

body length and convex-conoid rounded tail. It can be differentiated from the former by the longer stylet (283 vs 225 μm), by amphid-, body- and head-shape and by the presence of striations around the tail. It differs from the latter in body- and head-shape, stylet length (283 vs 203 μm), number of dorsal and ventral pores and structure of cuticle around the tail.

Remark: this is the first record of the genus for South America.

S U M M A R Y

Six species of Longidoridae are described from Bahia State Brazil. Three of them are new, belonging to the genera *Xiphinema*, *Xiphidorus* and *Longidoroides*, but only the *Xiphidorus* species is named, due to lack of specimens for the other two. *Xiphinema* sp. is closely related to *X. krugi* Lordello, 1955 and *X. dimidiatum* Loof *et* Sharma, 1977. It is distinguished from the former species by its longer anterior female genital branch and muscular structure of the uterus and from the latter by the absence of sclerotized spines in the uterus and by the structure of the uterus. *Xiphidorus minor* n.sp. is distinguished from all previously described species by the very short uterus. It resembles *X. saladillensis* Chaves *et* Coomans, 1984 but it can be differentiated by head-, amphid, and tail-shape and by a relatively longer stylet and pharyngeal bulb. *Longidoroides* sp. can be distinguished from all described species by the long stylet and habitus. Some further informations are given about *Xiphinema krugi*, *X. ifacolum* and *X. vulgare*.

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